

Strawman Flight Plans and their relevance to Science Objectives:

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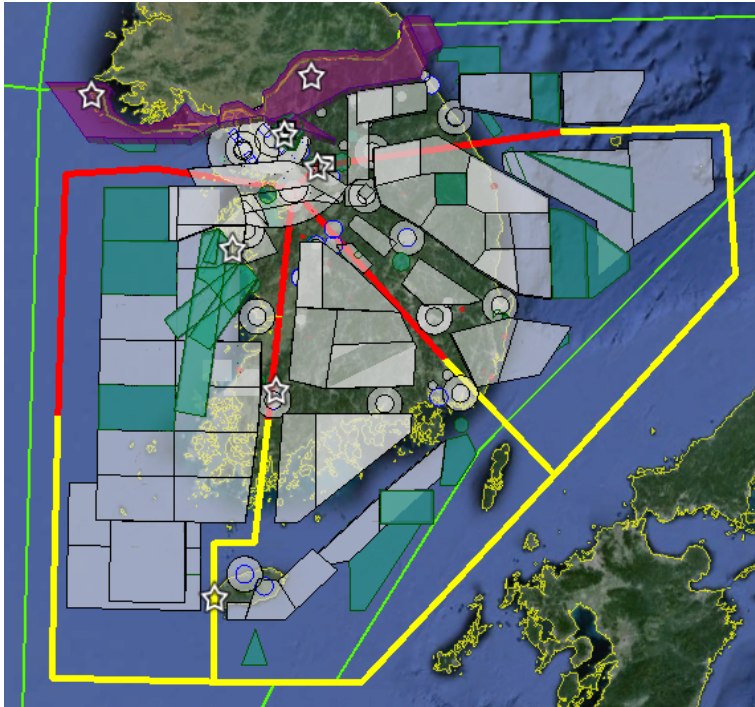
Consolidated Flight Goals in Support of Science Objectives and Related Questions

All of the science questions can be satisfied with broad sampling that includes upwind-downwind, marine-continental, and urban-rural environments at multiple altitudes and under diverse meteorological conditions.

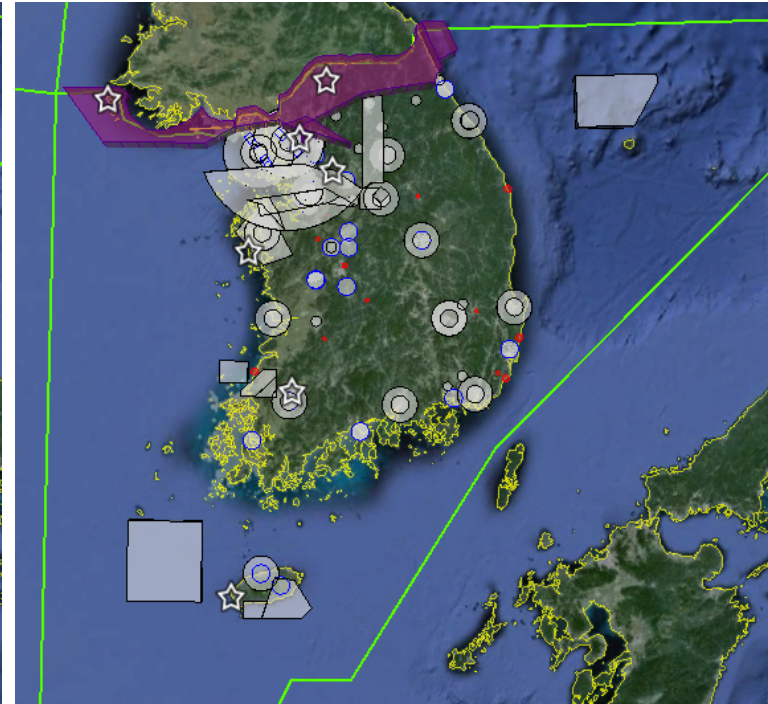
Obtaining this diversity calls for repetitive sampling over the same paths and locations over the six week study period.

Flight planning considerations: Special-use airspace varies by day and altitude

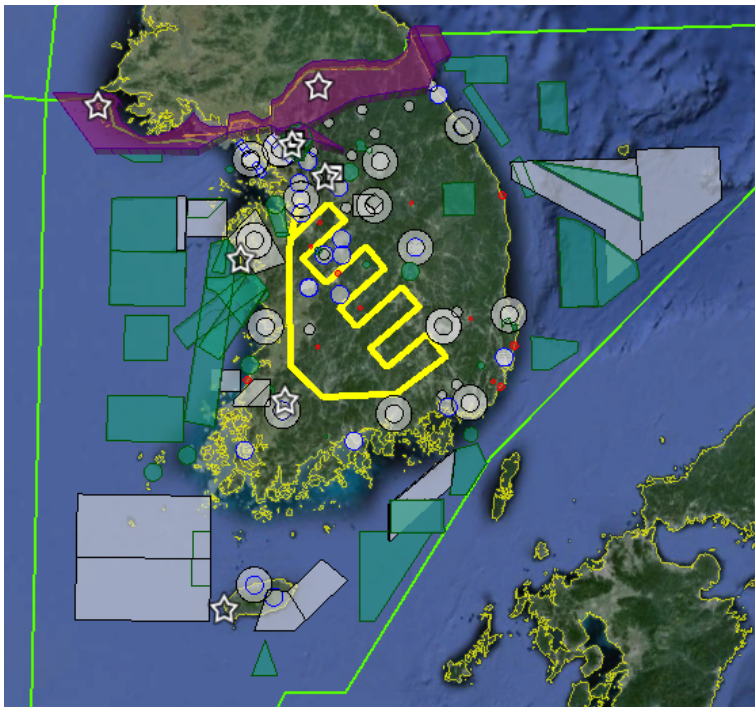
**Weekday
worst case**



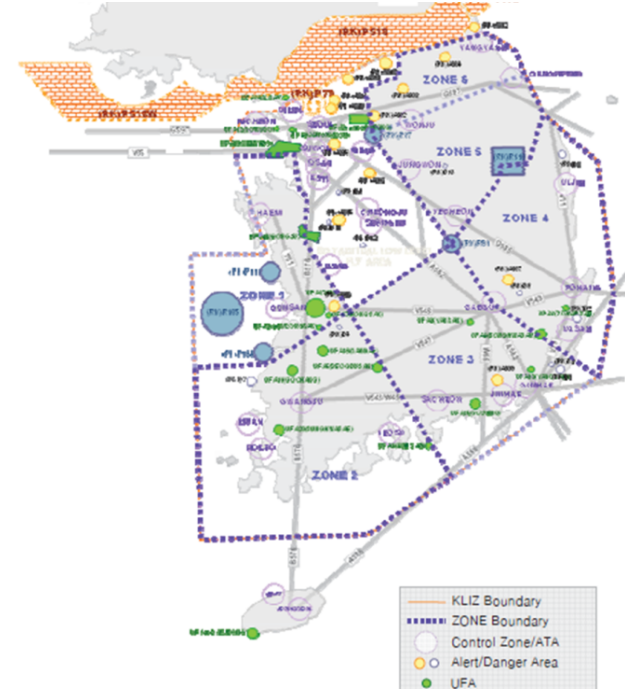
**Weekend
best case**



**Below
3,000 ft**

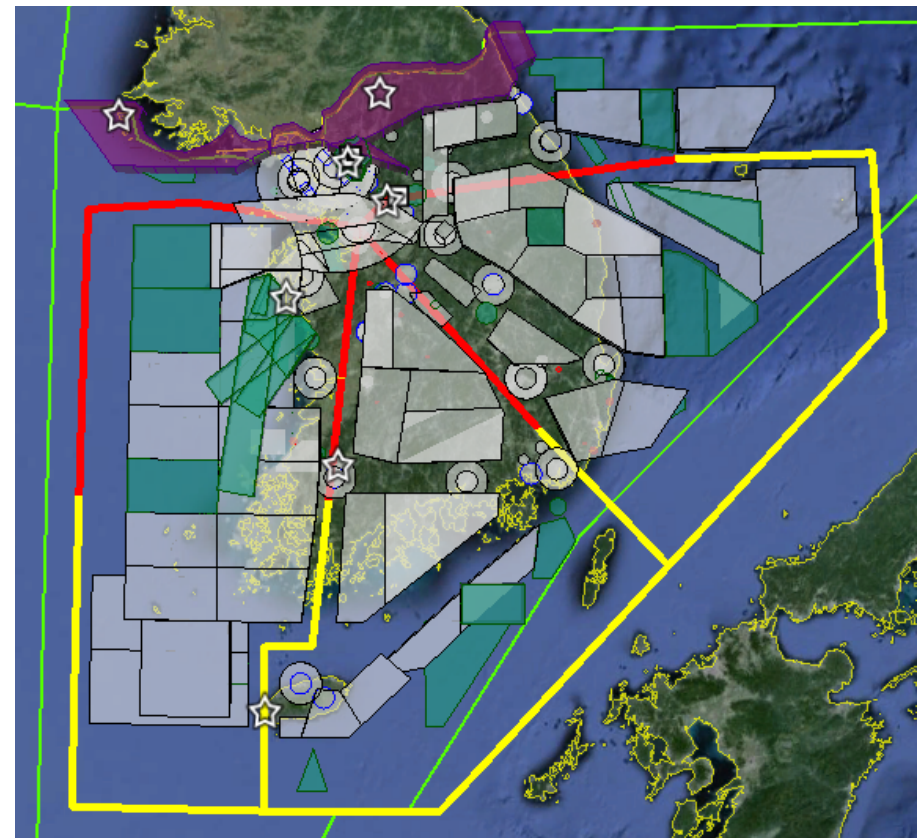


**Below
3,000 ft**

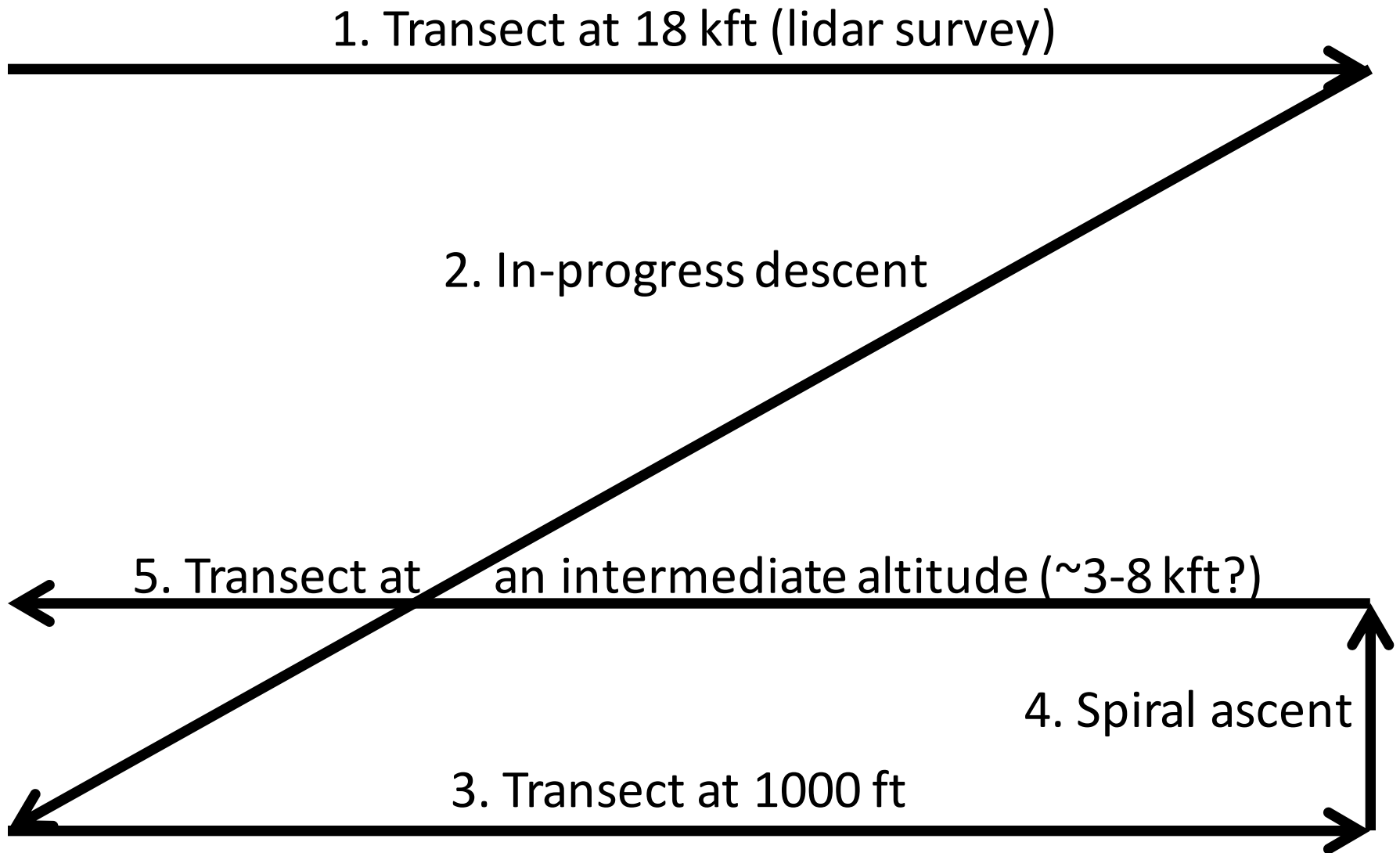


DC-8 Flight Sampling Considerations

- Repetitive sampling along corridors through special airspace (jetways) is the most workable strategy
- The red lines represent the extent to which the DC-8 could explore four of these corridors in an 8-hour flight with transects at four different altitudes.
- Advice from Osan staff indicate that flying an IFR flight plan without deviation is the best chance to get what we want.
- Specific flight plans choosing which portion of the jetways to sample would be filed the afternoon before each flight day.

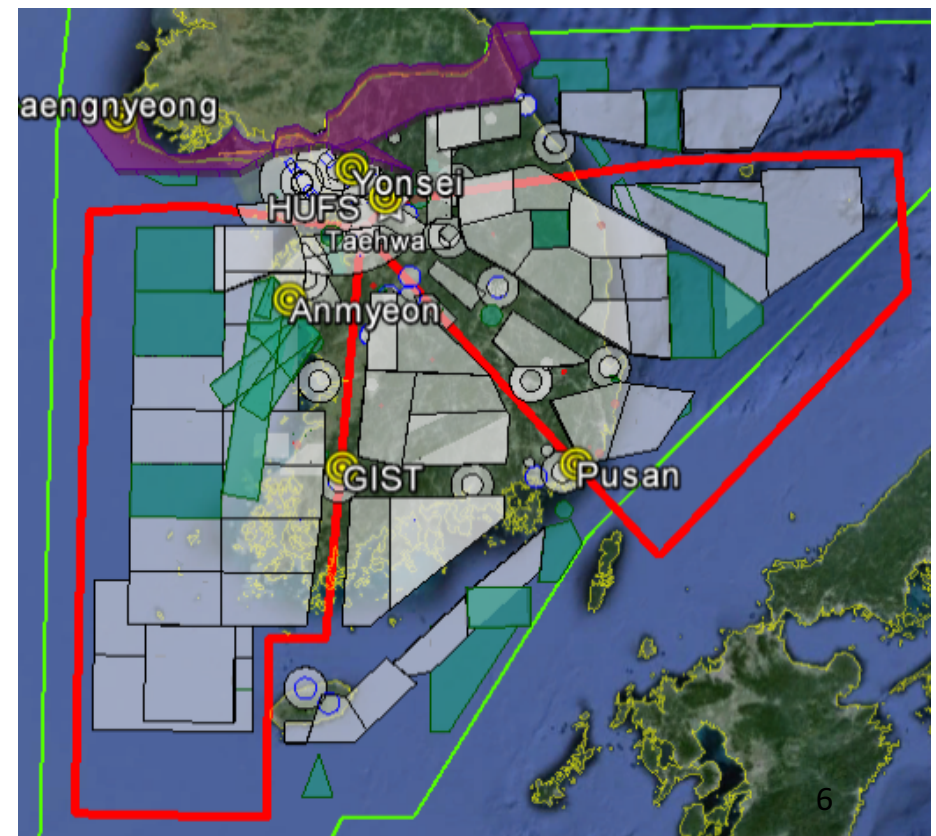


Vertical sampling strategy along the jetways



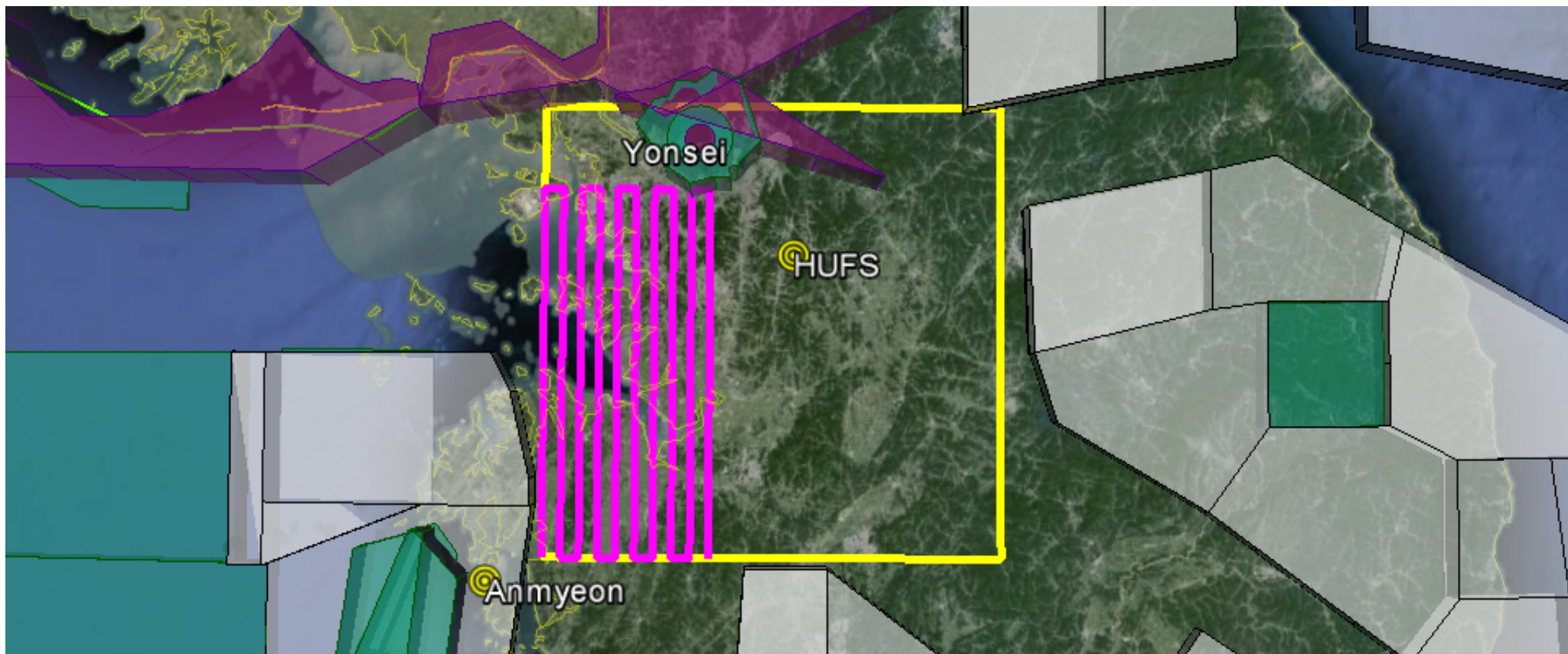
NASA King Air Flight Sampling Considerations (1)

- The King Air will conduct remote sensing from 28 kft.
- Sampling along the same corridors as the DC-8 would maximize integration into the larger sampling strategy.
- The King Air flies slower than the DC-8, but it does not need to cover the same ground at multiple altitudes.
- In 4 hours, the King Air could cover one of the two loops depicted in the figure to the right.
- With two 4 hour flights per day, the King Air could cover all four corridors and have some coincidence with the DC-8 along each corridor.

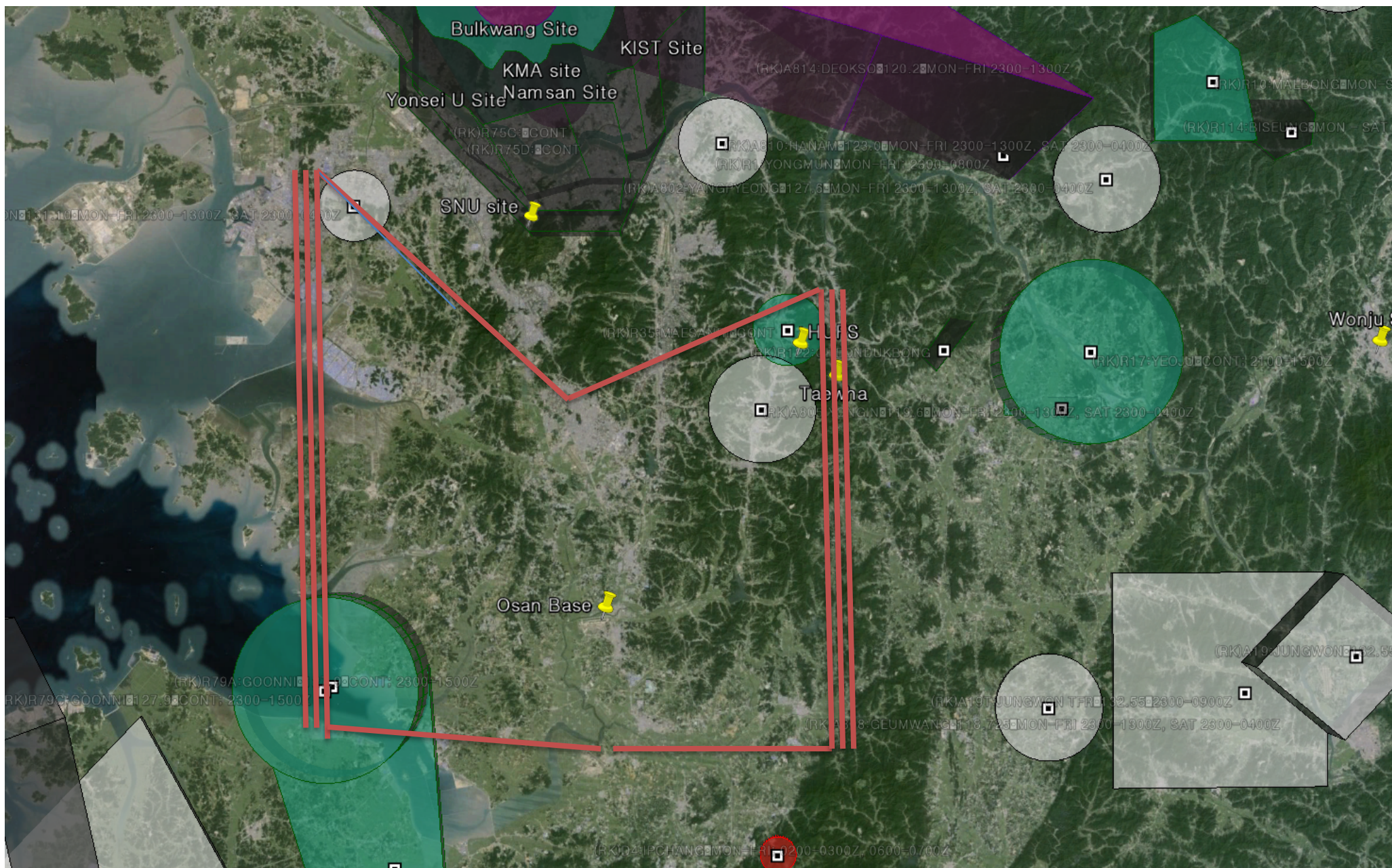


NASA King Air Flight Sampling Considerations (2)

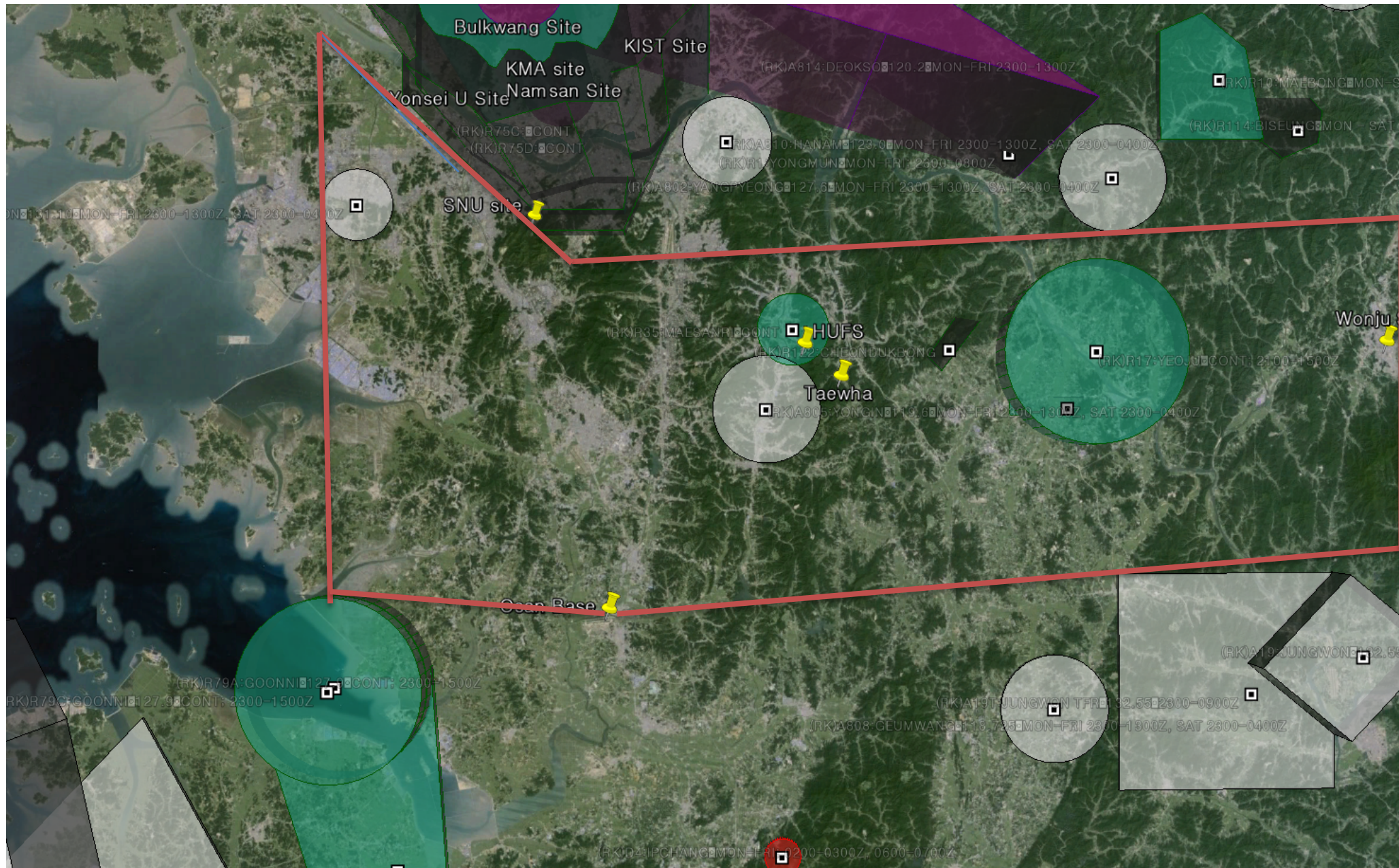
This image only shows special use airspace that extends above 20 kft. This opens a possible area over the Seoul Metropolitan Area (yellow box) to fly a pattern for mapping pollution. The magenta line shows the area that could be covered by the King Air in one sortie.



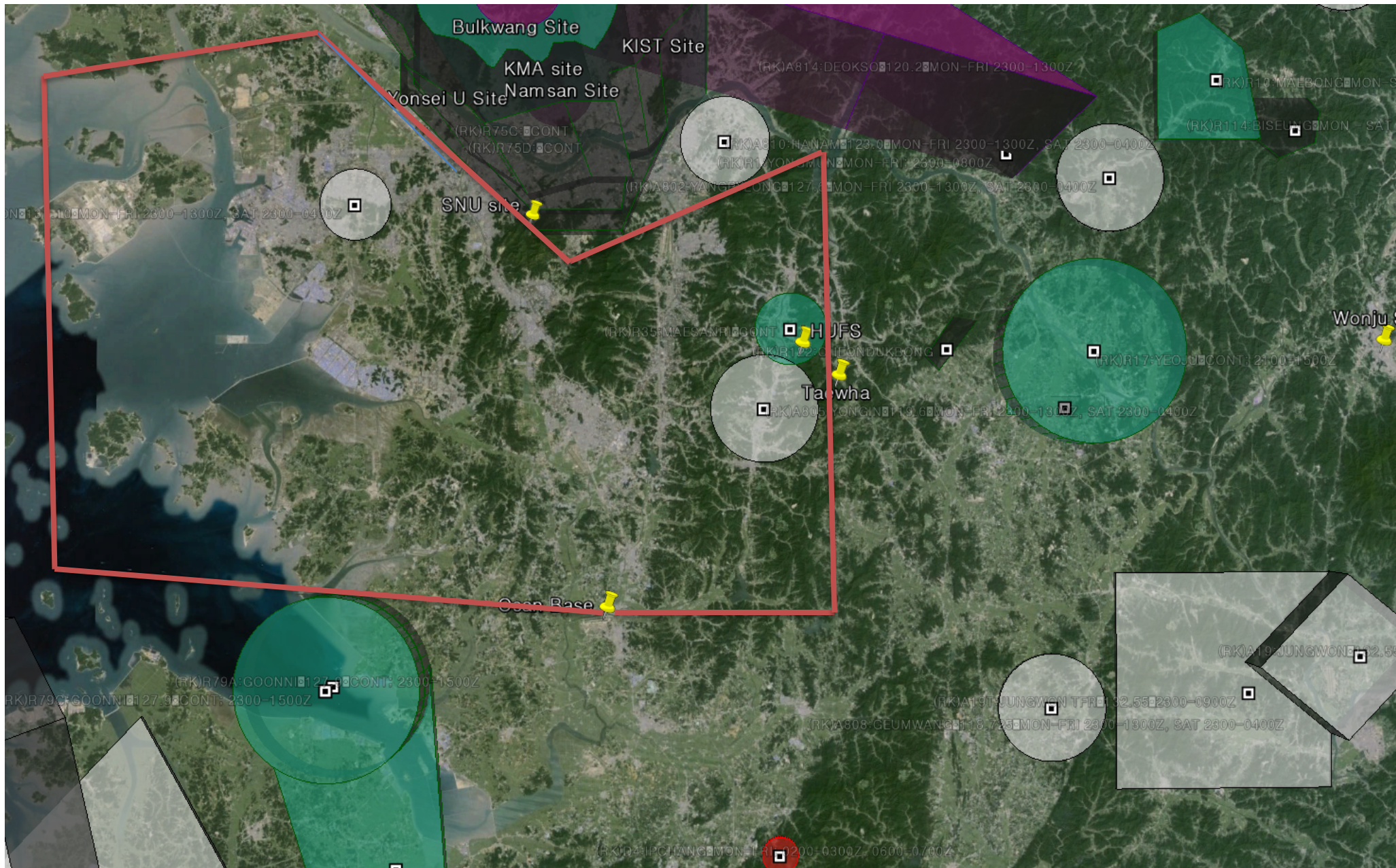
Strawman Flight Plans and their relevance to Science Objectives for Hanseo King Air



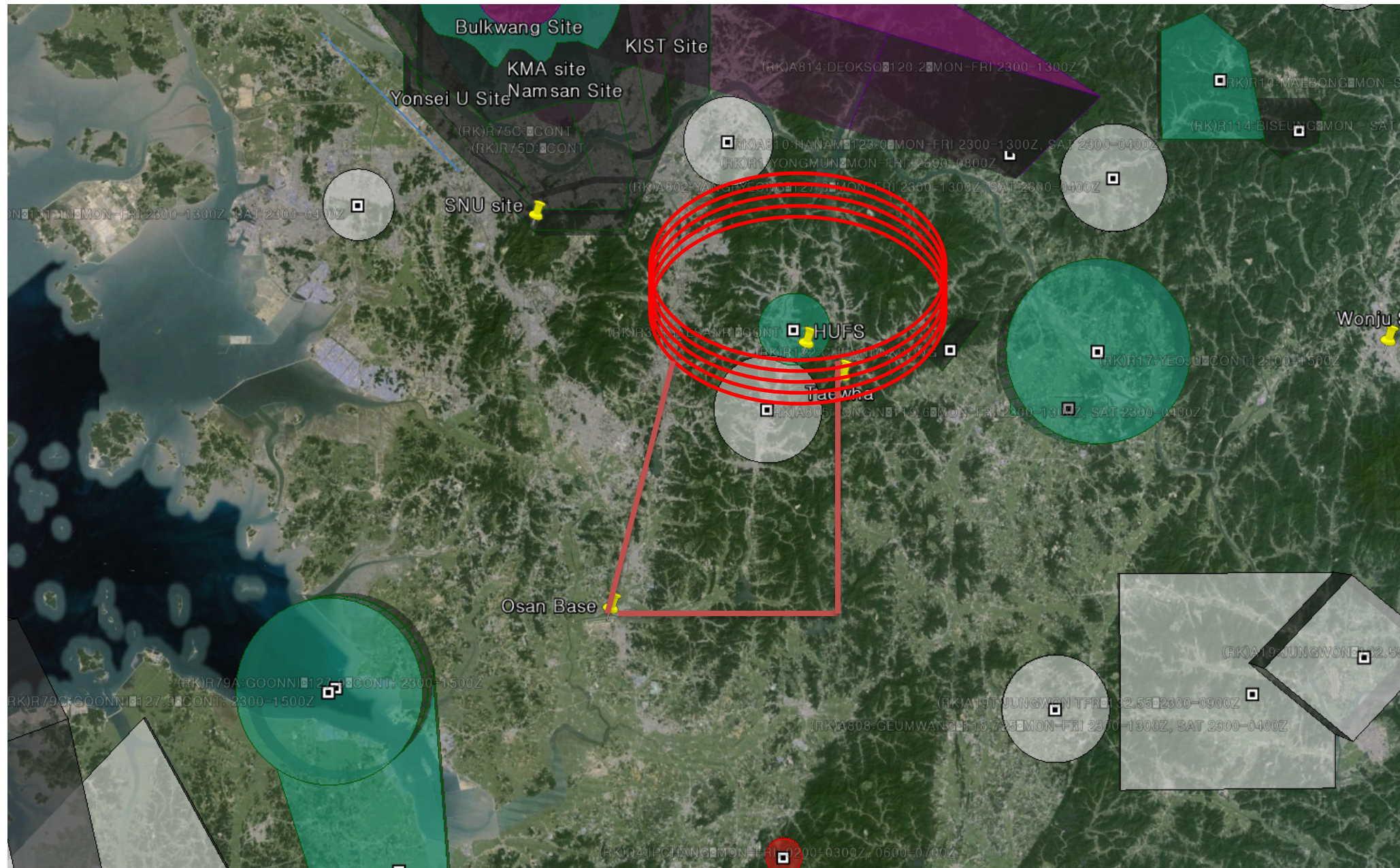
SMA in and out fast advection case



SMA in and out slow advection case

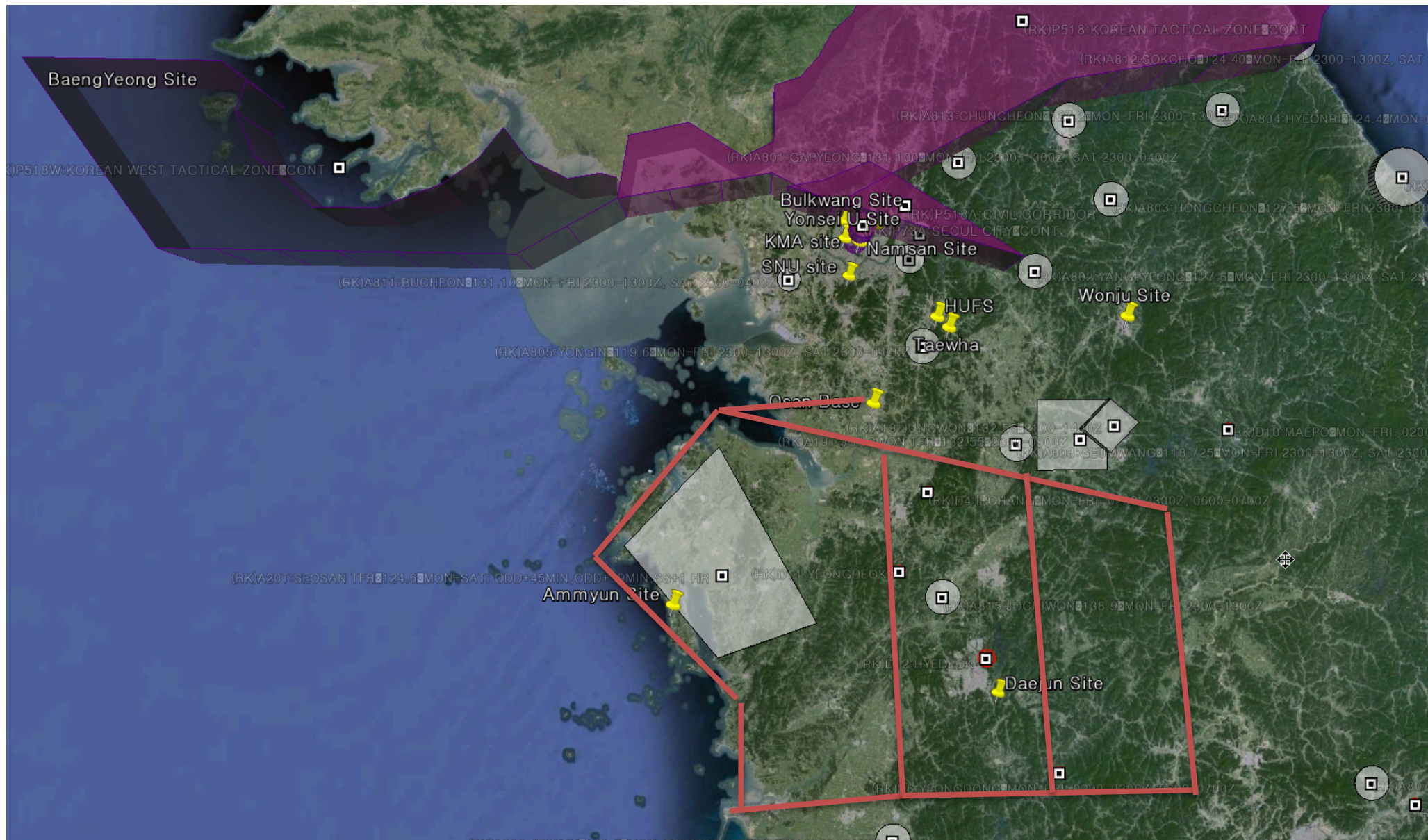


ground site intercomparison and urban plume

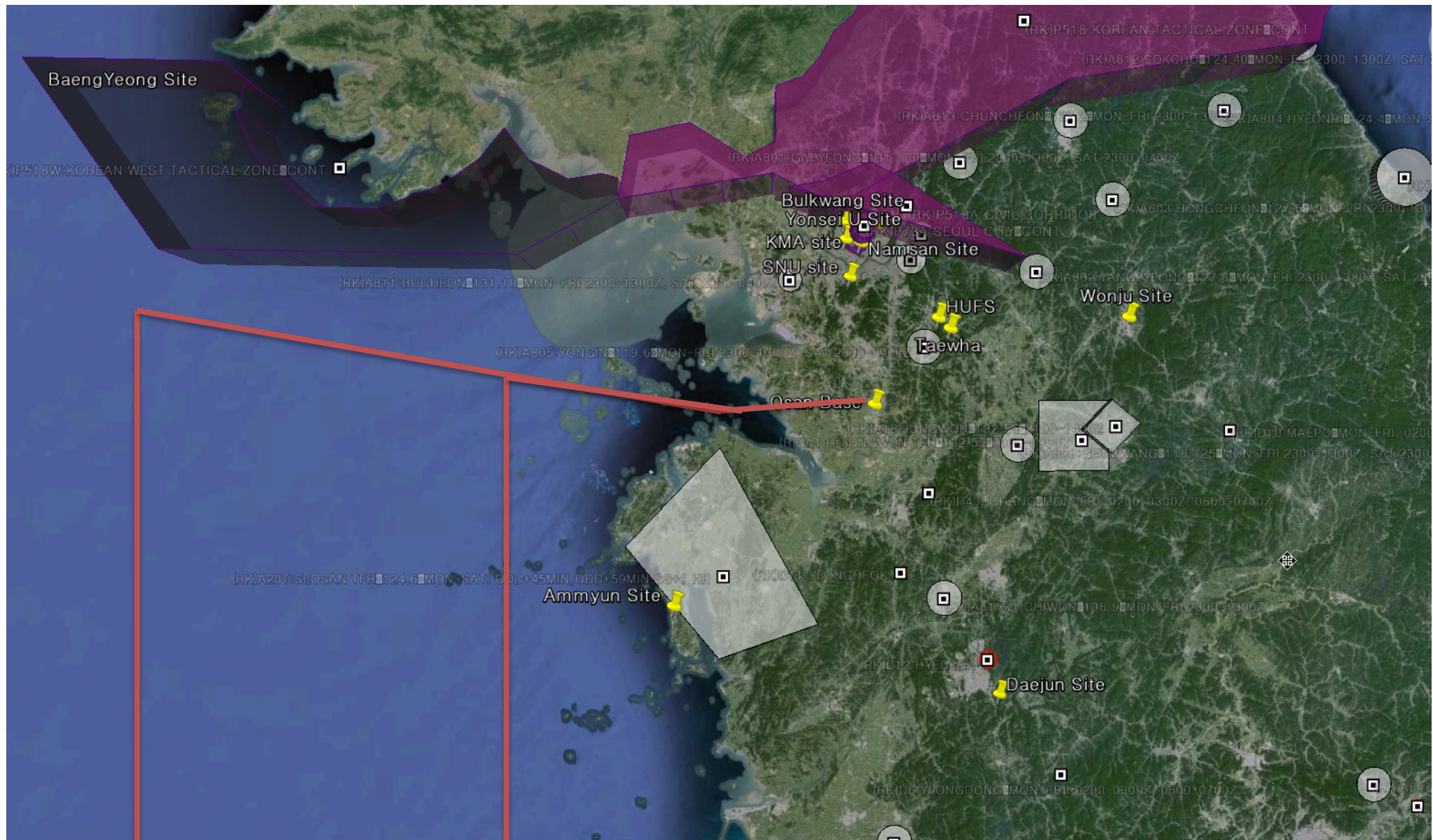


Weekend Scenario

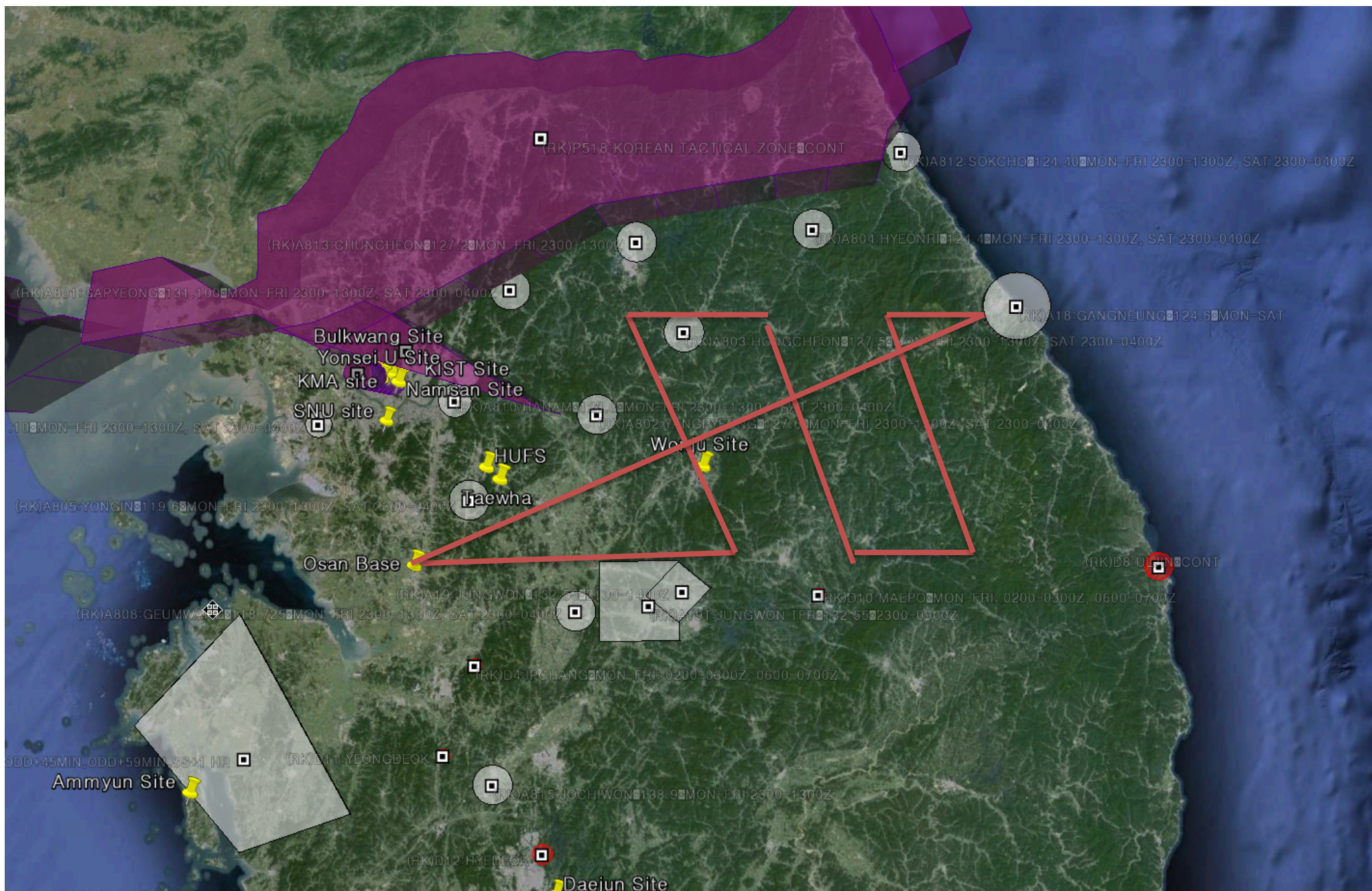
Giga Power plants and point sources



boundary layer transport case



Weekend : Biogenic and urban downwind lagrangian

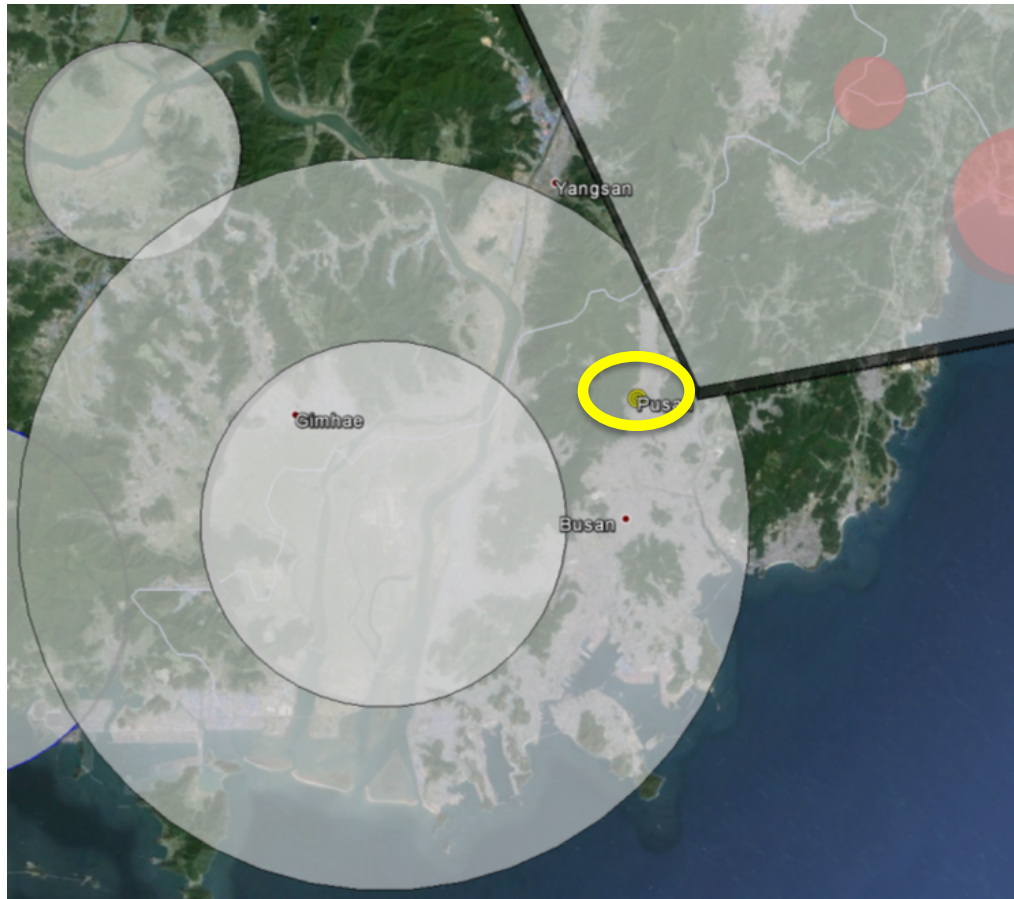


Overflight Coordination between the Aircraft and Ground Sites

- Scientifically, it is highly desirable to have overflight, including vertical profiling, over the ground sites.
- Current ground sites for the pre-campaign present significant airspace difficulties that will limit overflight altitudes and the level of proximity that can be achieved.
- We are not considering overflight of Baengnyeong Island or Yonsei University at this time unless there is knowledge on how they might be successfully requested.
- The following slides show the specific limitations at the remaining pre-campaign ground sites.

Airspace over the Pusan site

Weekday



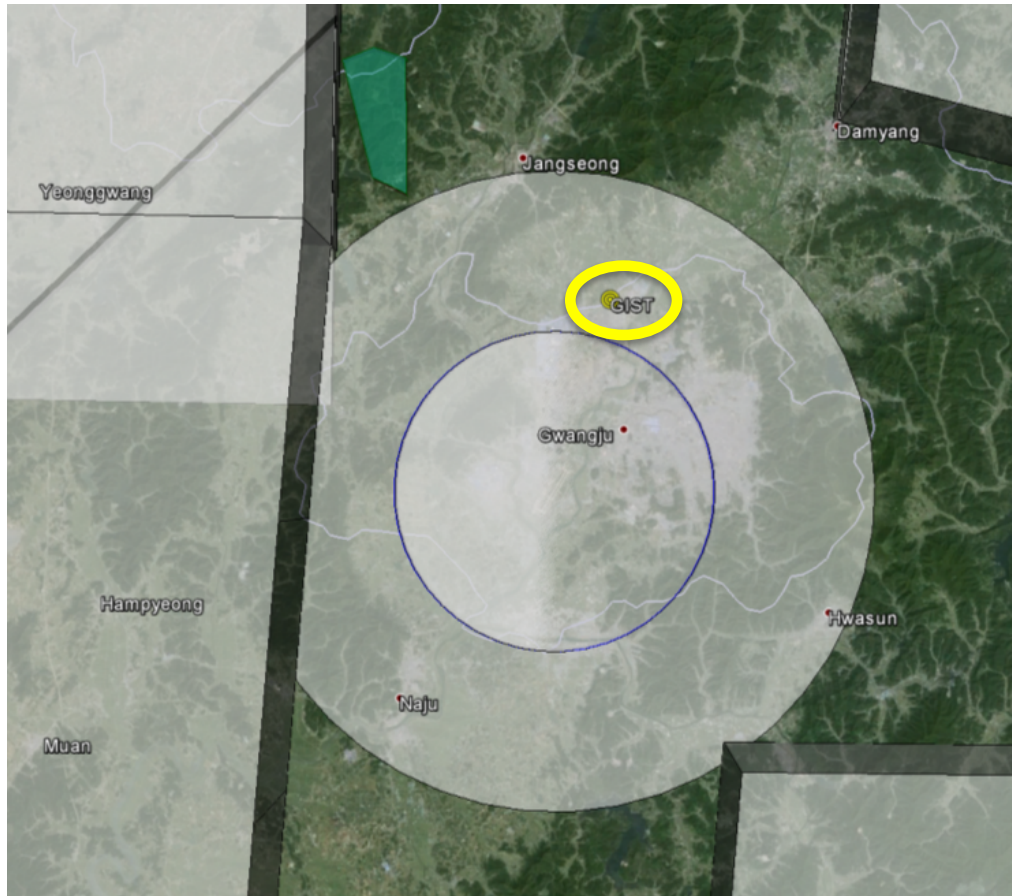
Weekend



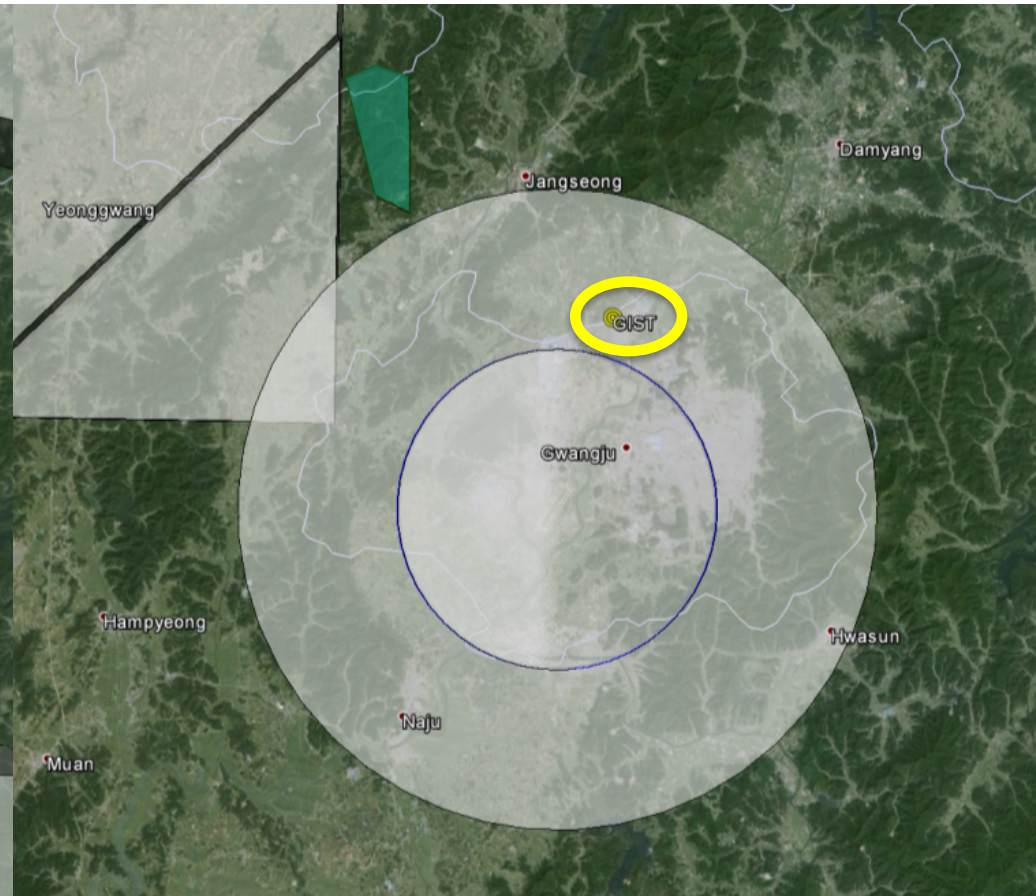
This site lies within the Class C airspace for Gimhae airport. No access below 5000 feet.

Airspace over the GIST site

Weekday



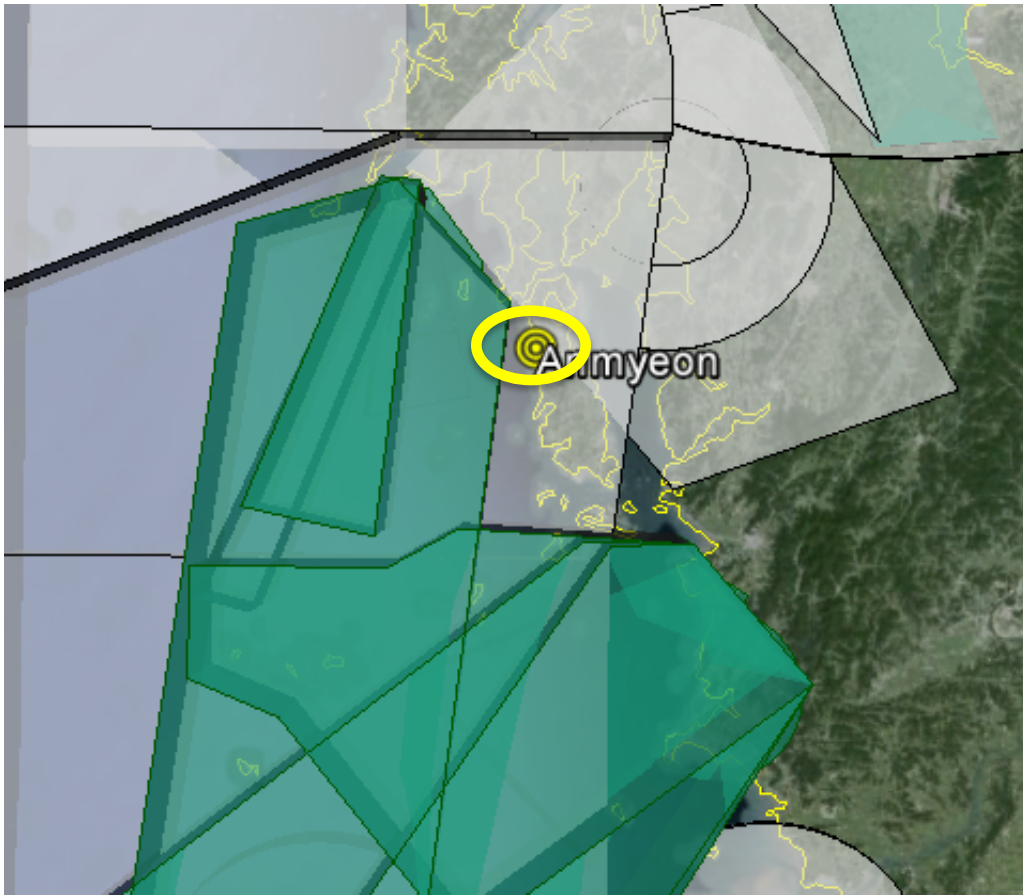
Weekend



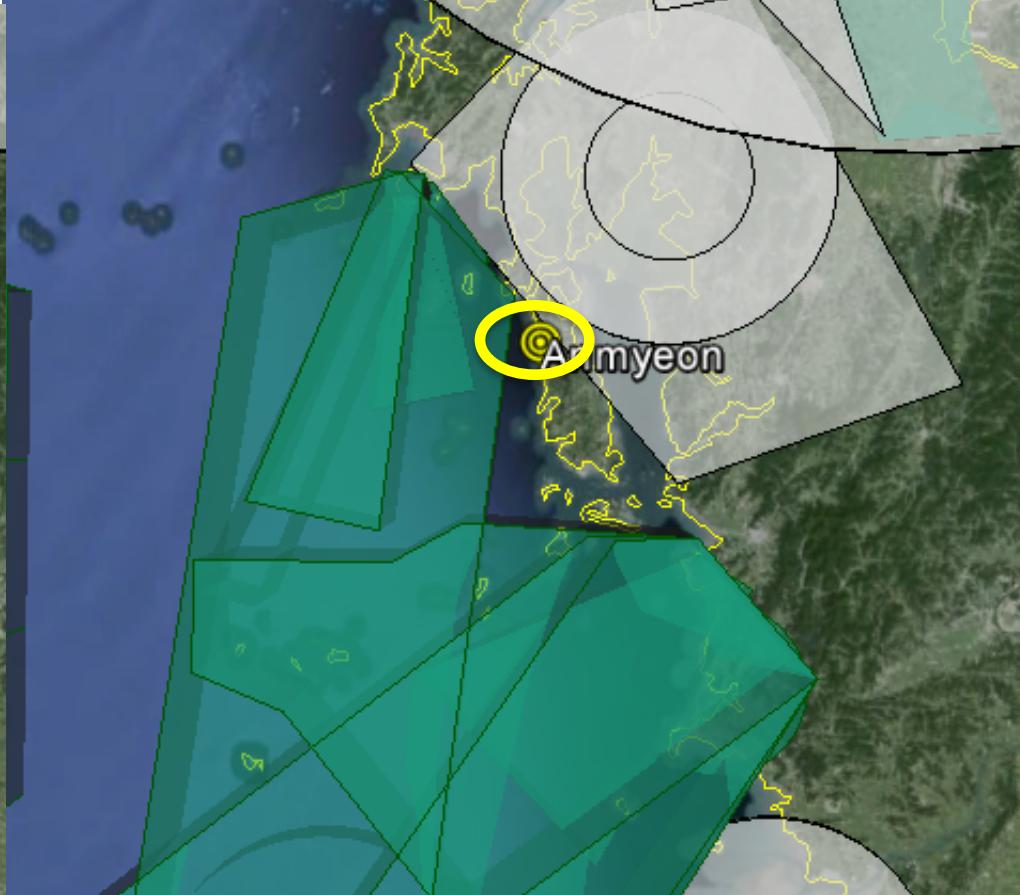
This site lies within the Class C airspace for Gwangju airport. No access below 5000 feet.

Airspace over the Anmyeon site

Weekday



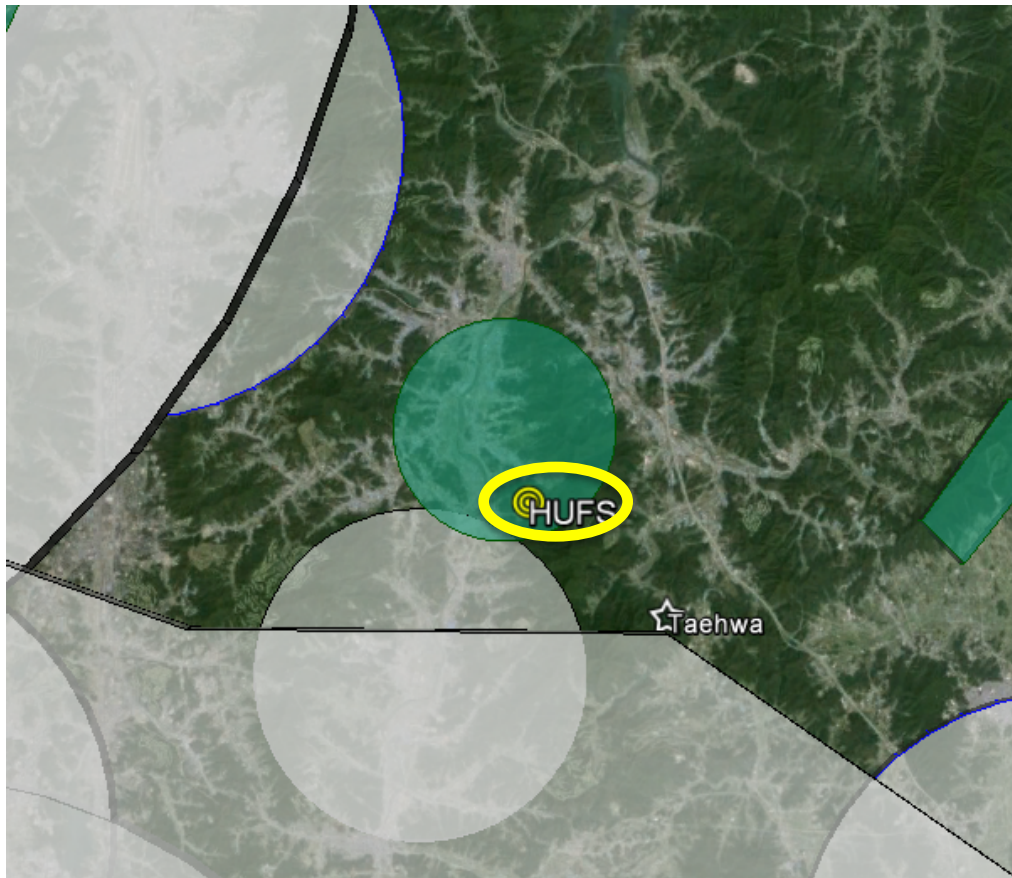
Weekend



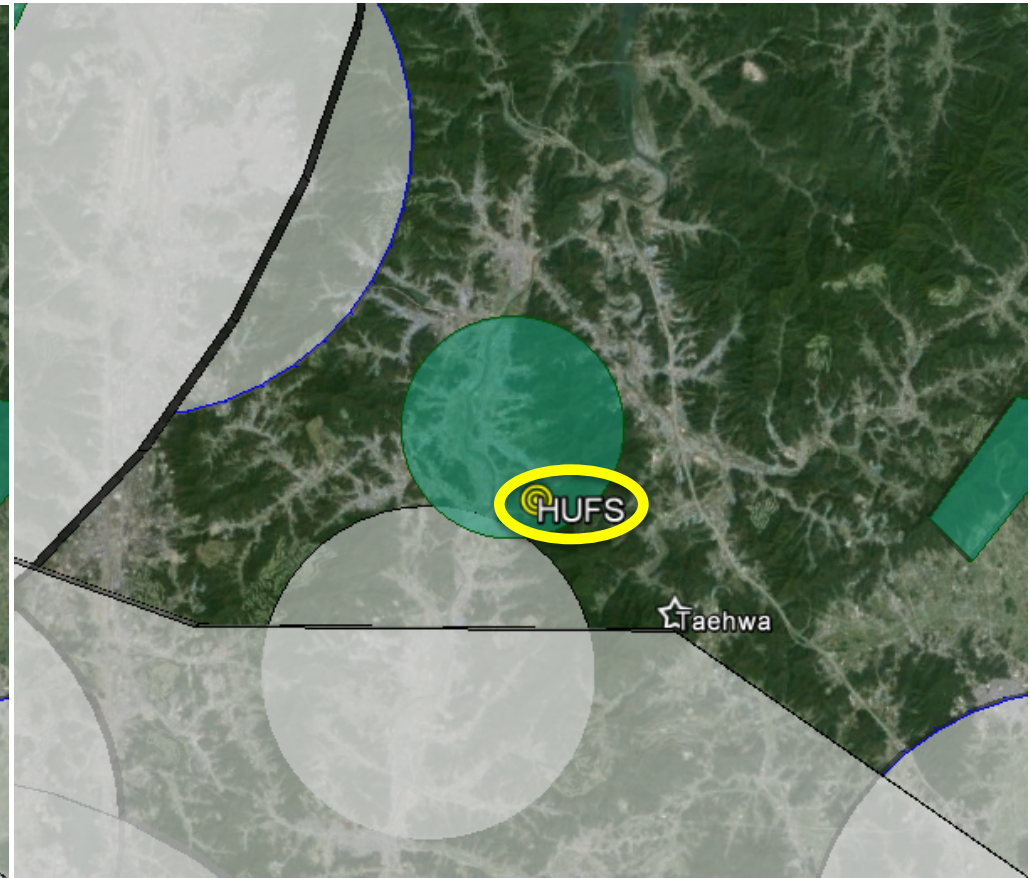
Navigation to this site could be possible, but complicated on weekends.

Airspace over the HUFS site

Weekday



Weekend



This site lies within a restricted area. No access below 2500 feet. Overflight of the Taewha Forest site appears feasible.

Open Questions and Issues for Research Flights (1)

- The current plans do not allow for night flights. Is this a strong desire? Quiet hours at Osan are from 2200-0600, meaning that no take-offs or landings are allowed during this time. Any exception would require a waiver and potential fines from the Korean government.
- The current plans do not allow for extensive mapping at low altitude. This would require special requests from the ROK Air Force.
- The current plan does not allow for vertical profiling over the ground sites. Is overflight at a few selected altitudes sufficient? Should we try to conduct missed approaches to reach lower altitudes adjacent to ground sites near airports?
- For the NASA King Air, what balance should we seek for mapping the SMA versus following the jetways?

Open Questions and Issues for Research Flights (2)

- Given the complex airspace and number of different controlling authorities, we need assistance on the NASA aircraft from Korean pilots who can assist with radio traffic and language translation. Are such personnel available?
- What are the challenges for airborne lidar operations? What authority do we need to contact for guidelines and approval?
- It is in our interest to plan a couple of visits to the Korean Air Traffic authorities to explain our flight strategies. These meetings should include both flight crew and scientists. Would this be possible? One visit early next year (January?) and shortly before the start of the campaign could make a big difference. Is there a single place to visit? We received contact information from Osan for relevant personnel at the Ministry of Land Transport and Maritime Affairs (MLTM); see slides that follow

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Radar Approach



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For our future

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Radair Approach

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